REMARKS/ARGUMENTS

Status of Claims

Claims 38, 40-45, 49-52 and 54 are pending in the present application.

Claims 38, 45, 49, 52 and 54 have been amended to overcome the Examiner's objections as explained in more detail below. Claims 39, 46-48 and 53 have been cancelled.

Written Description Requirement Rejections 35 U.S.C. 112

At paragraphs 1 to 2 of the Office Action, claims 38-46 have been rejected under 35 U.S.C. § 112 as failing to comply with the written description requirement. Specifically, the limitations recited in claims 38, 45 and 46 have been objected by the Examiner.

The Examiner has objected to the limitation recited in claim 38 "at least one performance metric measuring interference effects". Claim 38 has been amended to replace the expression of "at least one performance metric measuring interference effects on the wavelength" with the expression of "at least one performance metric describing the signal quality of the wavelength". Support for this amendment has been provided at least on page 13, lines 27-31 of the specification as follows:

> *"Each wavelength is associated with a matrix of performance metrics P_λ to describe its signal quality. Where it is assured that a set of wavelengths will always travel together, the set may be associated with the same matrix of performance metrics P_λ."*

The Examiner has objected to the limitations recited in claim 38 "identifying an upstream segment on the unidirectional path, and recalculating a value of the performance matrix by analyzing interference effects on the wavelength in the upstream segment". Claim 38 has been amended to replace the above limitation with "identifying a downstream segment on the unidirectional path, and recalculating a value of the performance matrix by analyzing interference effects on the wavelength in the downstream segment". Support for this amendment has been provided at least by Figure 2 and the following text on page 21, line 30 to page 22, line 3 of the specification.

> *"At step 204, for the transmitter node identified in step 202, a downstream segment and respective downstream node are identified to which the transmitter node transmits signals."*

The Examiner has objected to the limitation recited in claim 38 "for each upstream

segment connected to the node on the wavelength other than the upstream segment on the unidirectional path, recalculating the value of the performance matrix by identifying a transmitter node of the upstream segment on the wavelength". Claim 38 has been amended to replace the above limitation with "for each segment entering the downstream node connected to the downstream segment on the wavelength other than the downstream segment on the unidirectional path, recalculating the value of the performance matrix by identifying a transmitter node of the segment entering the downstream node on the wavelength, and analyzing interference effects on the wavelength while the signal passes through the transmitter node to the segment entering the downstream node". Support for this amendment has been provided at least by Figure 2 and the following text on page 22, line 26 to page 23, line 17 of the specification:

> *"At step 214 it is determined whether or not there are any other segments entering the downstream node identified at step 204. If there is another segment (yes path, step 214) entering the downstream node, the method proceeds to step 216. On the other hand, if there is not another segment (no path, step 214), then the method proceeds to step 220.*
>
> *At step 216 it is determined whether or not the new segment's upstream node is a transmitter not yet identified. If the new segment originates directly from a transmitter (yes path, step 216), then the method proceeds to step 204 so that that transmitter's downstream segments are all identified and analysed in accordance with step 204 to 220. On the other hand, if the new segment does not originate directly from a transmitter (no path, step 216) the method proceeds to steps 218 and then to step 202 in which the originating transmitter is identified by looking upstream. It is should be noted that if the new segment does not originate directly from a transmitter then in accordance with the present embodiment of the invention it should have performance metrics (data) associated with it, as indicated in Figure 2."*

The Examiner has objected to the limitation recited in claim 45 "at least one performance metric measuring interference effects". Claim 38 has been amended to replace the above limitation with the expression of "at least one performance metric describing the signal quality of the wavelength". Support for this amendment has been provided as mentioned in respect of claim 38.

The Examiner has objected to the limitation recited in claim 45 "recalculating the value of the performance matrix by analyzing interference effects on the wavelength in each of upstream segments on the wavelength". Claim 45 has been amended to replace the above limitation with "recalculating the value of the performance matrix by analyzing interference effects on the wavelength in each of downstream segments on the wavelength". Support for this amendment has been provided as mentioned in respect of claim 38.

Claim 46 has been cancelled to overcome the objection made to one of its limitations.

In view of the foregoing, Applicant respectfully submits that amended claims 38 and 45 meet the written description requirements, thus the rejection under 35 U.S.C. § 112 be

respectfully reconsidered and withdrawn.

Claims 49, 52 and 54 have amended to replace the limitation objected by the Examiner in respect of claim 38 and 45 "at least one performance metric measuring interference effects" with the expression of "at least one performance metric describing the signal quality of the wavelength". Support for this amendment has been provided as mentioned in respect of rejections of claims 38 and 45 under 35 U.S.C. § 112.

Claims 49, 52 and 54 have been amended to replace the limitation objected by the Examiner in respect of claim 45 "by analyzing interference effects on the wavelength in each of upstream segments on the wavelength" with "by analyzing interference effects on the wavelength in each of downstream segments on the wavelength". Support for this amendment has been provided as mentioned in respect of rejection of claim 45 under 35 U.S.C. § 112.

Novelty Rejections under 35 U.S.C. 102(e)

At paragraphs 3-4 of the Office Action, claims 38-47, 49 and 52-54 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Levandovsky et al (United States Patent No. 7,905,956 B2).

Claim 39, 46, 47 and 53 have been cancelled, thus the claim of novelty to these claims is moot.

Claims 38, 45, 49, 52 and 54 have been amended to incorporate the following feature recited in cancelled claim 39:

> *"wherein the at least one identified base variable is one or more of the fibre type, the length of the segment, the number of wavelength, the length for each fibre span within the segment, the power level input into each span.'*

Claims 45, 49, 52 and 54 have also been amended to include the feature recited in amended claim 38 as follows:

> *"for each segment entering the downstream node connected to the downstream segment on the wavelength other than the downstream segment on the unidirectional path, identifying a transmitter node of the segment entering the downstream node on the wavelength, and analyzing interference effects on the wavelength while the signal passes through the transmitter node to the segment entering the downstream node."*

Applicant submits that Levandovsky et al does not disclose the following features recited in amended claim 38:

i) defining a performance matrix by identifying at least one performance metric describing the signal quality of a wavelength along a signal path, and calculating the value of the performance matrix by analyzing interference effects based on at least

one identified base variable of the fibre type, the length of the segment, the number of wavelength, the length for each fibre span within the segment, the power level input into each span;

ii) at each of the plurality of nodes along an unidirectional path, for each segment entering the downstream node connected to the downstream segment on the wavelength other than the downstream segment on the unidirectional path, recalculating the value of the performance matrix by identifying a transmitter node of the segment entering the downstream node on the wavelength, and analyzing interference effects on the wavelength while the signal passes through the transmitter node to the segment entering the downstream node.

These two features effectively simplify the algorithm applied to a method of determining the viability of an optical path by obviating the need for full non-linear simulation, thus improve the speed, efficiency and flexibility of routing algorithm. Specifically, developing a set of metrics describing the impact of different fiber types and lengths bearing a number of wavelengths on one of the wavelengths prorogated by input power, as described in feature i), permits the prediction of a wavelength's behavior by simple calculations. At the same time, both distortive effects and noise effects can be identified during the calculations (see page 7, lines 10-27 of the specification). Further, feature ii) shortens the analysis time for calculating the optical effects of all the associated transmitter nodes and their downstream segments for a wavelength travelling along the optical path (see Figure 1, Figure 2 and pages 22-25 of the specification).

In contrast, Levandovsky et al. teaches a method for validating a path route through a switched optical network by replacing traditional complex non-linear algorithm with an algorithm approximating linearization for the entire noise propagation (see col. 23-24, lines 7-11 of Levandovsky et al.). Specifically, the linearization approximation is determined by calculating a cumulative optical signal to noise ration (SNR) at the output of every element along the path including a total noise figure (see col. 1, lines 64-66, col. 3, lines 49-60).

However, Levandovsky et al. does not teach defining a set of metrics and calculating the value of the metrics based on one or more variables of fiber type, the length of the segment, the number of wavelength, the length for each fiber span within the segment, the power level input into each span, as described in feature i). As well, Levandovsky et al does not teach analyzing interference effect using the above mentioned variables, described in feature i), on a particular wavelength. Instead, Levandovsky et teaches calculating noise figure based on a few parameters including an equivalent average number of noise photons per bit (see col. 3, lines 50-60, and col. 6, lines 12-24 of Levandovsky). Indeed, when Levandovsky explains why photon numbers is used for analyzing interference effects, it distinguishes its invention from a BER Estimation algorithm using optical power launched into a fiber on a particular wavelength (see col. 19-20, lines 15 to page 21-22, line 33). In particular, Levandovsky states the differences on col. 21-22, lines 29-31 as follows:

> *"Use of photon numbers instead of optical powers is more convenient at this point because it avoids making the treatment dependent on the bit rate, and a photo-*

detector integration constant."

None of the parameters of fiber type, the length of the segment, the number of wavelength, the length for each fiber span within the segment, the power level input into each span, as described in feature i), appears in any one of equations calculating SNR and noise figure as taught by Levandovsky. Further, although Levandovsky teaches optical parameters as fiber type and the number of wavelength for a static optical route design (see col. 17-18, lines 20 to col. 19-20, line 10 of Levandovsky), it nevertheless disregards this method by stating on col. 19-20, line 1 as follows:

> *"Such custom route-optimized approach is not feasible in a switched network environment."*

Moreover, Levandovsky teaches a routing generating algorithm by a single hop along a tentative path route through a switched optical network for calculating noise figure recursively. However, it does not teach applying feature ii) to calculate a performance metric taking into account all transmitter nodes and their downstream segments associated with each node along a signal path when a wavelength travels. Instead, Levandovsky only teaches not to pick up a NE from a list of the prohibited nearest neighbor NEs (see col. 7, lines 1-16 of Levandovsky).

Therefore, amended claim 38, as well as claims 40-44 which depend thereon, is not anticipated by Levandovsky et al. For at least the same reason, the corresponding apparatus and medium claims 45, 49-52 and 54 including feature i) and ii), are novel in view of Levandovsky et al.

For view of the foregoing, Applicant respectfully submits that novelty rejections under 35 U.S.C. § 102(e) be reconsidered and withdrawn.

Obviousness Rejections under 35 U.S.C. 103(a)

At paragraphs 5-6 of the Office Action, the Examiner has objected to cancelled claim 48 and claims 50-51 as being unpatenable over Levandovsky et al. in view of Beine et al (US Patent 6,701,087 B2).

Applicant submits that claim 48 has been cancelled.

The law on obviousness under 35 U.S.C. 103 was recently addressed in *KSR Int'l Co. v. Teleflex, Inc.,* 127 S. Ct. 1727 (2007) where it was held that obviousness is a question of law based on underlying factual inquiries. The underlying factual inquiries include: "the scope and content of the prior art"; "differences between the prior art and the claims at issue"; "the level of ordinary skill in the pertinent art"; and "secondary considerations [such] as commercial success, long felt but unsolved needs, failure of others, etc.").

Applicant submits that Beine et al does not cure the deficiencies in Levandovsky et al mentioned above. It is further submitted that since feature i) and ii) are neither taught or

suggested by the prior art, Applicant respectfully submits that the claim 38, as well as claims 40-44 which depend thereon, are not obvious in view of Levandovsky et al over Beine et al. For at least the same reason, the corresponding apparatus and medium claims 45, 49-52 and 54 are not obvious in view of Levandovsky et al over Beine et al.

For at least the above reasons, Applicant respectfully submits that the obviousness objections under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Each of claims 38, 45, 47, 49, 52 and 54 has been amended to replace term "interference" within the expression of "identifying at least one dominant source contributing to each identified interference effect" with term "optical". This voluntary amendment is to fix a problem of the claims in which term "each identified interference effect" does not have an antecedent.

Conclusion

In light of the amendments and arguments contained herein, Applicants submit that the application is in condition for allowance, for which early action is requested.

If the Examiner has any remaining informalities to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such informalities.

In view of the foregoing, early favorable consideration of this application is earnestly solicited.

Respectfully submitted,

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